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TECHNOLOGY AND INDUSTRIAL EXPORTS

A MICRO-ECONOMIC ANALYSIS

OF ARGENTINA'S RECENT EXPERIENCE

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I. INTRODUCTION

The theory of international trade has found it difficult, since "Leontieff's paradox" 1/, to find alternative explanations to Ohlin's model, based on the relative endowment of factors of production. In fact, since Leontieff argued that the American export industries were less capital intensive than those which competed with imports, the simplistic two factor model faced important difficulties. 2/.

For this reason, the literature of the last decade has tried to explore new ways of developing the received analytical framework. We observe, on the one hand, the attempts to recreate the neoclassical model by incorporating "neo-factors" of production - such as technology, research and development expenditure, learning, etc. 3/. By broadening the spectrum of factors it is intended to show that the "error" does not lie in the theoretical conception, but in its simplified two factor version.

On the other hand, a second approach tries to connect the analysis of international trade with the theory of direct foreign

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1/ W. Leontieff, "Factor Proportions and the Structure of American Trade: Further Theoretical and Empirical Analysis", Review of Economics and Statistics, November 1956, pp.386-407.

2/ Hufbauer actually attributes to Ohlin the formulation of a much more complex and realistic theory than the oversimplified two factor version to which reference is always made. See G. C. Hufbauer, "The Impact of National Characteristics & Technology on the Commodity Composition of Trade in Manufactured Goods", in R. Vernon (ed.), The Technology Factor in International Trade, National Bureau of Economic Research, 1970, p.167.

3/ See, for example: a) M. Posner, "International Trade and Technical Change", Oxford Economic Papers, October 1961; b) R. Vernon, op. cit.; c) F. Fordham, Economic Growth and Foreign Trade, J. Wiley & Son, New York, 1970, (in particular Chapter VII); d) M. Teubal, "Comparative Advantage and Technological Change: The Learning-by-doing Case", Journal of International Economics, Vol. 3, May 1973, pp.161-178.

investment 4/.

Both lines of thought are closely linked to the recent development of the so-called "product cycle" theory, which has attempted to integrate into a more comprehensive framework the part played by both technological progress and the multinational corporation in the contemporary development of international trade 5/.

Although we consider this integration quite fair - that is, technology and multinational corporations cannot be absent from an analytical framework which succeeds in throwing some light on the subject of international trade - we think that certain characteristics of the product cycle theory require greater attention because of the significance they may have for the export activity of relatively less developed countries. In particular we refer to the concept that this theory gives us about the "maturity" of an industrial product. This is one of the subjects examined in this monograph, in which we study the manufacturing export performance of Argentina in recent years. Together with this country, others in Latin America - especially Brazil and Mexico - have shown during the last few years a significant increase in their exports of relatively sophisticated industrial products, such as, for example, tractors, cars antibiotics, machine-tools, electromechanical capital equipment, accounting machines, etc. What is more, companies from these countries also appear as incipient exporters of technology and capital, as they figure more and more frequently as suppliers of complete industrial plants to other countries in the region through "turnkey" contracts, or as capital exporters undertaking programmes of multinational expansion through the opening of subsidiaries in other countries of the continent 6/.

4/ Ch. Kindleberger, The International Corporation, a Symposium, MIT University Press, 1970; and American Business Abroad, Yale University Press, 1969.

5/ R. Vernon, "International Investment and International Trade in the Product Cycle", Quarterly Journal of Economics, May 1966.

6/ Several Argentine companies have expanded their activities to other Latin American countries, and we have now found more than 30 cases of exports of complete industrial plantes. It is interesting to emphasise that, apart from these manufacturing plants, there have also been sales of technology and engineering services for the construction of public works and infrastructure.

Even though the product cycle theory contains a number of hypotheses which help to explore this field, some of its assumptions fail to capture the complexity which arises from the actual facts. Thus, for example, the product cycle theory would seem to assume that the semi-durable and capital goods exported by the less developed countries are completely standardized products. However, many of these products exported by the countries in question involve substantially modified versions of the original technologies, a fact also quite evident in the export of complete plants. This leads us to think that the "product cycle" theory also assumes a steady and quite linear process of knowledte transference from countries with high levels of expenditure on research and development activities to the more backward countries. Perhaps it would be more correct to visualize a number of "relative cycles" related to the structural capacity of a given country to absorb, 'adopt', and 'improve' foreign knowledge, which in turn would be connected with its human resources and the complexity of the industrialization process which it has already undergone.

The following are examples:

Companies Which Have Established Subsidiaries

COMPANY	ACTIVITY	COUNTRY IN WHICH ESTABLISHED
Siam di Tella	Electromechanical	Brazil
Roque Vassalli	Agricultural Machinery	Brazil
Industrias Siderúrgicas Grassi	Ferro-alloys	Brazil
Rosati & Cristofaro	Metal Structures	Venezuela
Laboratorios Bagó	Pharmaceutical Products	Peru
Aurora	Electronic Lighters	Brazil & Spain

Companies Which Have Sold Complete Plants

COMPANY	TYPE OF PLANT SOLD	COUNTRY
SKI Ingeniería	Self-contained Meatpacking House and Freezing Plant	Cuba
Eximparg S.A.	Cottonseed Oil Plant	Bolivia
Astilleros Vicente Forte	Shipyard	Cuba
Argental S.A. Benito Roggio & Hijos	Self-contained Bakery	Cuba
	Airport	Paraguay
Meitar S.A.	Plant for Citric Juices Concentrates and Jams	Cuba

In the same way as in the classic models, in which innovation and technological leadership give comparative advantages in international trade, in this study also technological change takes on a crucial role. In this case, however, we emphasise not the "major" technological changes which characterise the classic theory of innovation, but the accumulated flow of "minor" innovations arising from those scientific and technical activities which will be hereby called "adaptive" inventive activity. It will be argued later on in this paper that such scientific and technical activities are closely linked to the growth path of efficiency and overall factor productivity growth of any specific industrial firm and may lead to a dynamic change in its comparative advantages on the international scenario.

The classic economists recognized that technological leadership and innovation gave comparative advantages in international trade. In fact, they recognized the existence of different production functions which formed the basis for the existence of comparative advantages. Contrary to that, the neoclassical theory of international trade rests on static assumptions, the trade flow being attributed to differences in the relative availability of factors considered to be units of non-differentiated labour accumulation of homogeneous capital, and given natural resources.

In other words, the Ohlin-Heckscher model considers identical production functions for different countries, thus reflecting the assumption of perfect dissemination of information and technology. As a result, this model fails to give to the available level of technological knowledge the role which it does in fact play in international trade. In fact we argue here that such a characterization implies a relatively incomplete or inadequate specification of accumulated technological knowledge as a factor of production. We believe that such knowledge must be treated as a cumulative variable in the production function, in a similar way as we treat capital accumulation in the production relation.

The development of new techniques and production processes affects the comparative advantages of any given firm (country) for the production of certain goods, and therefore seriously affects the assumption of identical production functions of the Ohlin model. Given that technology is imperfectly disseminated, the trade flow may originate in the accumulation of technological knowledge actually available to each society. In our hypothesis here trade flows emerge not from differences in the relative endowment of conventional factors (capital and labour), but from differences in the state of the art accessible to a particular firm.

At this point it is appropriate to distinguish between "major" and "minor" innovations. The former, according to Schumpeter, are those which introduce major changes in the production function, while the latter involve technical changes which arise from the accumulation of plant experience, and improvements in products or processes introduced after the major innovation 7/.

Bearing this distinction in mind, it follows that the comparative advantages position could be influenced both as the result of the appearance of a "new" product or production process, and also as a consequence of a modification in the design of existing products or processes, or even through the improvement and adjustment of the latter through time. It is significant in this respect to observe that various microeconomic studies carried out in relatively industrialised countries show that a large fraction of the observed productivity increase is due to the accumulation of "minor" innovations rather than to great leaps forward, jumps, or "breakthrough" innovations 8/. Several different studies carried out recently indicate that such a mechanism also operates in relatively less developed countries and that in them, as well as in more developed societies, the growth of productivity also depends in a crucial manner on the domestic technological and engineering efforts which bring about a flow of improvements and adjustments to products and/or processes. 9/.

It will be postulated here that in those branches of industry in which the international technological frontier has moved at a relatively slow pace in the last few years, and in which, at the same time, domestic technological learning has been significant, the conditions have appeared to allow for a gradual change in the

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7/ With regard to the difference between major and minor innovations, see Jorge Katz, Importación de tecnología, aprendizaje local e industrialización dependiente, Fondo de Cultura Económica, México, 1976.

8/ See, for instance, S. Hellander, The Sources of Efficiency Growth, MIT University Press, 1966.

9/ As a general reference for this kind of work, see R. Cibotti and J. Katz, Marco de referencia para un programa de investigaciones en temas de ciencia y tecnología, CEPAL, Buenos Aires, 1975.

dynamic comparative advantages with which different Latin American countries operate. This change may involve the export of fairly sophisticated industrial products, and the gradual strengthening of a new pattern of international specialization. In fact, it is to be expected that unit production costs will fall and/or the quality of the products will rise pari passu with each successive technical innovation. This process is partly the result of technological learning at plant level, which permits a more rational use of resources and the utilization of engineering routines and technical solutions more appropriate to the local environment, to the nature of available inputs, etc. When this process takes place concomitantly with a slow down of the international innovative frontier, the company might eventually be able to achieve a competitive position in international trade, making possible the appearance of trade flows not necessarily feasible in the original situation.

II. INDUSTRIAL EXPORTS: CURRENT EXPLANATIONS AND A COMPLEMENTARY HYPOTHESIS

At the end of the sixties a new phenomenon began to appear in the area of international trade. In fact, a number of traditionally raw material exporting countries attained remarkable success as industrial exporters of products of a fairly high of technical complexity. The newcomers to the league constitute a heterogeneous group of nations with regard to their economic structure, their greater or lesser degree of industrial integration and their experience as far as import substitution is concerned. When a comparable outcome can be observed arising from such structurally dissimilar situations as those which prevail in Taiwan and Argentina, or Hong Kong and Brazil, it becomes necessary to find some sort of explanatory theory 10/. Leaving aside the special circumstances affecting each country, in every case two common elements have been noticed: 1) the use of policy instruments addressed at promoting exports of this kind and 2) the fact that multinational corporations play a crucial part in the export business. Consequently, attempts have been made to explain the process of industrial exports from countries like Argentina and Brazil in the following, non-exclusive, ways:

a) Industrial exports result from a systematic policy of oversubsidizing exports. In other words, what is being said is that by means of credit facilities, drawbacks, tax deductions, etc., the State grants to the industrial sector a subsidy which allows it to compensate for its relative inefficiency in relation to international standards, and therefore compete internationally. The present line of thought bears a certain resemblance to that related to import substitution subsidization throughout the 1950's and 1960's 11/.

10/ An excellent article which outlines the different kind of manufactured exports that develop in countries like Taiwan is G. K. Helleiner's "Manufactured Exports from Less Developed Countries and Multinational Firms", The Economic Journal, March 1973.

11/ In a recent paper Carlos Díaz Alejandro asks to what extent the import substitution process of the last few decades has acted as a necessary precondition to stimulate the present export capacity. Even though it is still too early for the features of this new stage to be studied and understood properly, the authors

b) Industrial exports are a reflection of the world-wide strategy followed by multinational corporations. Considering that a large part of the relatively sophisticated manufactured exports come from a small number of subsidiaries of international enterprises, and that a substantial part of this trade corresponds to intra-company transactions, it could be assumed that the phenomenon has little relation with domestic circumstances, and rather reflects the maximization strategy of the firms involved. This approach examines the subject from the point of view of the MNC theory and the theory of foreign investment.

Hypothesis of this Paper

These two ways of looking at the manufacturing export problem give but a partial vision of reality. There is no doubt that both explanations underlie the export phenomenon to a greater or lesser degree, but in our view both of them excessively simplify the facts. Being based on aggregate data, and leaving aside the analysis of the products actually exported, they lose sight of the significance of those products in the industrial setup of the exporting countries. The hypothesis presented in this paper does not question the validity of either of the explanations described in the preceding section, but aims to give them a wider historical and industrial perspective. In fact, we consider that these new exports reflect - besides what has already been said - a deep structural process associated, on the one hand, with the diffusion of technological knowledge between countries, and on the other, with different forms of domestic technological learning in the receiving countries. We shall argue here that both phenomena - international dessemination of technology and learning - can generate, over time, changes in the pattern of comparative advantages of the kind of countries studied in this paper 12/. This hypothesis recalls both the

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consider that probably the functional relation between the two developmental stages deserves further study. See C. Díaz Alejandro, Some Characteristics of Recent Export Expansion in Latin America, Paper 183, Economic Growth Center, Yale University Press, 1973.

12/ Note that even starting from a similar idea with regard to the dynamic character of comparative advantages in international trade, authors like Keith Griffin maintain that it always works against less developed countries, which implies a vision of reality diametrically opposed to that put forward in this monograph. See

literature on the product cycle and that concerning the Japanese case. However, there are important differences which it is necessary to keep in mind.

According to the product cycle theory, new technology is transferred from countries with a high level of expenditure on research and development activities (for example, the United States) to those which have an industrial structure capable of duplicating such technology (for example, Europe and Japan). Eventually, the same technology, once standardized, flows to more backward countries.

It is also assumed that the latter are only capable of competing in "mature" products, which require little (or no) change in the state of the art. Therefore, the product cycle theory does not anticipate learning processes in the kind of countries which concern us here, nor does it foresee the emergence of technological activities in adaptation and improvements of products and processes. However, recent research concerning the industrial sectors of Argentina 13/, Brazil 14/ and Mexico 15/ reveals the existence of a significant domestic technological activity in sectors such as iron and steel, vehicles and machinery, chemicals and petrochemicals, pharmaceutical products (in the case of Argentina) etc.

Keith Griffin, "La transmisión internacional de la desigualdad", Comercio Exterior, Mexico, August 1976.

13/ Examples of this type are the studies by Jorge Sábato, Roque Carranza and Gerardo Gargiulo, Ensayo de régimen y tecnología, el caso de la fundición ferrosa, (mimeo), Buenos Aires, 1974, Jorge M. Katz, Oligopolio, firmas nacionales y empresas multinacionales. La industria farmacéutica argentina, Siglo XXI, Buenos Aires, 1974, A. Petrecolla, R. Zubieta, H. Abrales and J. Nogués: Industria electrónica y progreso técnico en un contexto de industrialización, Instituto Torcuato Di Tella, Buenos Aires, 1974.

14/ Ibid. In the Brazilian case, see the articles by F. Almeida Biato, E. Guimaraes and M. Figueredo, Potencial de pesquisa tecnológica no Brasil, IPEA, Brasilia, 1971.

15/ Ibid. In the Mexican case, see M. M. Garza, Technological Change as an Investment Process. Theoretical and Empirical Aspects, (doctoral thesis on the Mexican firm, Hojalata y Lámina), MIT, Cambridge, Mass., 1969; B. Bueay: Contribuciones para una teoría de la integración de la industria de procesos, (mimeo), Resistol de México, 1973.

This empirical evidence calls into question the technological scenario which underlies the product cycle theory. Moreover, given that in many of these fields exports from Argentina, Brazil and Mexico have increased at a spectacular rate, it seems interesting to ask what the relationship is between these exports and the flow of internal technological activities carried out at the level of individual firms.

Even when it is recognized that these exports are associated both with the subsidies received by the companies, and with different kinds of corporate strategies followed by the multinational firms involved, one cannot fail to see that the export capacity in industrial products of a certain degree of sophistication cannot be due exclusively to the will of entrepreneurs or the use of a subsidy by the State. In actual fact, even before a subsidy or the location of an export activity in a particular country can be considered, there must exist a minimum threshold of technical capacity not only at plant level, but sufficiently spread throughout the whole industrial sector, in order to allow production to be carried out with a reasonable degree of efficiency. This technical capacity cannot be attained overnight as it has to do with labour skills and with a certain level of accumulated industrial development. In other words, behind the export process hereby examined lies an important transformation of the industrial structure of Argentina, Brazil, etc., and it is in this latter phenomenon that lies the real determining factor upon which the expert phenomenon rests.

By way of an example, it can be pointed out that the 1956 Carabela model of Kaiser Argentina (one of the first motor cars ever produced in this country) would have been difficult to export quite independently of any subsidy granted to it. It was a case of an outmoded car (with regard to the world technological frontier of the time) and produced outside a reasonable range of international costs. Twenty years later the Argentine motor industry shows a completely different picture. On the one hand, the technological lag, with respect to the international technological frontier has diminished markedly: the Ford Taunus, for example, entered the home market just a year and a half after Ford's German subsidiary had introduced the same model in the European context. On the other hand, the experience accumulated by the industry has allowed a significant reduction in the production costs, bringing them considerably nearer to international standards. Finally, it is important to observe that the car mentioned absorbed, prior to its launching on the Argentine market, nearly 230,000 hours of domestic activity in adaptive engineering, redesign, etc., which reveals that it is far from being a completely standardized product, as

the "product cycle" theory would have it.

What has happened in the course of these two decades? On the one hand, it would appear that the international technological frontier in the automotive industry (it may be possible to extend this argument to other branches of industry) has not moved forward at a pace which would imply substantial modifications in the state of the art 16/. On the other hand, the technological strengthening of the home industry has triggered off a domestic learning process. The two things together have produced a gradual closing of the technological gap which separates the Argentine automotive industry from its counterparts in more developed countries.

It is appropriate to make it clear that the concept of learning which is being used here is not limited exclusively to the learning of the labour force along the production line, or of the technical engineering section of the plant. There is also a fair amount of learning to be attained in company administration as well as in non-manufacturing areas, which have repercussions on the overall productive efficiency of any given company. For example, an adequate rate of capacity utilization, which can often be achieved only on the basis of expenditure on product and/or process engineering, aimed at optimizing the use of equipment, dyes, etc., also has an important learning consequence upon the financial areas of the company or, more generally, in management activities.

Let us now look at the Japanese case. In spite of the big differences between Japan and Argentina, Brazil, etc., certain characteristics of the Japanese model are present in the cases hereby examined. It seems appropriate to distinguish between capacity to use creatively technology which has been developed by third countries, and leadership in the development of new technology. Some recent studies indicate that, even though Japan shows considerable success in the first of these two avenues, it has not necessarily done so well in the second 17/.

16/ The major of research in the automotive industry has in recent years concentrated almost exclusively on two areas of particular concern in the United States. These are pollution and safety. Outside these areas there have been no important conceptual changes in motor car structure.

17/ M. Peck: The Infusion of Technology and the Mysteries of the Catch-up, (mimeo), Yale University, 1973; H. Kitamura: "Foreign Aid and Investment: a New Challenge to Japan", The Developing Economies, Vol. X, December 1972, IDE, Tokyo.

It is also obvious that by making this comparison, we do not mean to ignore the basic differences which prevail both in relation to the scale of the phenomenon described and with reference to the main actors involved. While in the Japanese case the principal character on the industrial scene has been the national industrial entrepreneur, in countries like Argentina or Brazil this element has played a relatively marginal role, the large multinational corporation being the promoter and direct beneficiary of the technological modernization process. We shall return to this subject in the last section of this paper.

Synthesis

This paper does not claim to study the overall export boom which Argentina has experienced during the last few years. Rather, its scope is limited to the examination of recent trends concerning the export of manufactured products of a fairly high degree of technological sophistication. In particular, attention will be given to the relationship between these exports and several micro-economic indicators of technological learning and local research and development activities. It will be argued that the recent expansion of industrial exports is partly the result of a significant change in the technological standing of local manufacturing industry and that this involves a dynamic modification of the pattern of comparative advantages with which this country operates on the international scene.

III. VOLUME AND STRUCTURE OF THE FLOW OF EXPORTS OF "RELATIVELY SOPHISTICATED" INDUSTRIAL PRODUCTS

In order to examine the previously stated hypothesis, the flow of Argentina's manufacturing exports throughout the period 1969-1974 will be analyzed. The aim is to take the study to the highest possible level of disaggregation, for which reason we shall work with statistical evidence referring to the company and specific product level.

However, before going into details, it seems appropriate to examine: a) what the overall performance of Argentine manufacturing exports has been over recent years; b) what has hereby been defined as a "relatively sophisticated" manufactured product; and c) the nature of the sample of industrial companies upon which we have based the analysis to be presented.

This information will allow us to locate the relative weight of those exports of relatively sophisticated industrial products in relation to overall exports of non-agricultural products and these in turn relative to the country's total exports during the last few years.

a) Development of Overall Manufactured Exports

The period 1969-1974 marks a stage of sustained growth in Argentina's overall exports. Thus, while in 1969 these reached a total of 1,611 million dollars, in 1974 they were up to 3,929 million dollars; that is, they had increased at an accumulated annual rate of almost 20%.

Within the overall picture, total exports of manufactured goods shows a growth performance well above the average, since it succeeded in achieving an annual growth rate of 30%, rising from 507 to 1,867 million dollars.

It is not, however, industrial exports as a whole which concern us here. For this reason, we have judged it necessary to define a sub-category within this group, which will be called exports of "relatively sophisticated" industrial products.

b) Sub-group of "Relatively Sophisticated" Industrial Exports

For the purpose of the present study we are interested in

Table 1. Argentine Exports, 1969 - 1974
(millions of dollars)

Exports	1969	1970	1971	1972	1973	1974
Primary Products	1 104	1 173	1 124	1 221	1 919	2 062
Manufactures of Agricultural Origin	341	408	405	442	750	1 031
Manufactures of Industrial Origin	166	191	211	278	596	836
Total	1 611	1 722	1 740	1 941	3 265	3 929

Source: Secretaría de Estado de Comercio Exterior.

defining a certain subgroup of industrial products in which the level of technological sophistication both of the final product and of the manufacturing processes seems relatively higher than that of manufacturing production on average.

With this aim in mind we have excluded from the study those chapters of the Argentine export nomenclature concerned with food products and those derived from agriculture and livestock, since these are traditional items in Argentine exports and use production techniques which have been locally available for several decades 18/.

Therefore, the first 24 chapters of the NADE nomenclature have been excluded from the sample. They include animal and vegetable products, fats, oils and foodstuffs and beverages. Minerals and metals exported unprocessed were not included either, nor did we consider traditional chemicals such as tannins, dyes, etc.,

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18/ It is true that in many of these items there have been significant advances in the technology used in their production (dehydration techniques, rapid cooling, etc.), distribution, or marketing (packaging techniques, container transport, etc.). In a longer paper these subjects should receive special attention, since their importance is undeniable in a country with a broad-based and diversified primary production from the point of view of its future export capacity. We need go no further than the list of complete plants so far exported by Argentina, which indicates the significance of the food sector.

leather and its manufactured products, wood, wool, cotton and textiles made from them.

As a result of the definition adopted, attention was centered on those products with some degree of technological sophistication, which represent 25 chapters - a considerable proportion - of the tariff nomenclature, the development of which is set out in the following table.

Table 2. Growth of "Relatively Sophisticated" Industrial Exports

(millions of dollars)

Item	1969	1970	1971	1972	1973	1974	1969/74
Total Exports (1)	1 612.0	1 773.2	1 740.3	1 941.1	3 266.0	3 985.0	14 317.6
Products considered to be relatively sophisticated (2)	157.0	176.8	200.3	258.5	522.7	745.4	2 060.7
{(2)/(1)}100	9.74	9.97	11.51	13.32	16.00	18.71	14.39

Source: Instituto Nacional de Estadística y Censos, Anuarios de Comercio Exterior.

As can be seen, the regrouping of industrial exports coincides, in broad terms (it is slightly lower), with the heading "Manufactures of Industrial Origin" in Table 1 19/.

19/ This suggests that for the purpose of defining "Exports of Industrial Origin", it makes practically no difference whether we work at an aggregate level of eight digits - as in Table 1 - or 4 digits - Table 2. Given the much smaller amount of information which has to be handles in the latter case, this seems to be an acceptable option.

Both tables indicate that the industrial exports which concern us in this study have doubled their share of total exports, now representing between a sixth and a fifth of the overall annual value. This indicates that the experts of relatively sophisticated industrial products cannot be ignored in the design of a policy for the external sector. As will be shown throughout this paper, a policy of this kind should include considerations of a technological nature in view of the fact that technology constitutes an important part of the explanation of the growth process under examination.

c) Concentration and Growth of Exports of Relatively Sophisticated Industrial Products

Table 3 presents: a) the chapter number of the NADE classification of each of the 25 groups studied here; b) their contents in terms of industrial products; c) the flow of exports in each item for the period 1969-1974; and finally, d) the accumulated value of the exports in each category in the period under consideration. The figures are given in dollars at current values.

From a reading of the figures in Table 3 two structural features arise which it is interesting to analyze further. The first refers to the high concentration of exports in a few chapters of the NADE classification. The second is the remarkable growth rate attained in certain chapters.

To visualize better the degree of concentration by chapters, Table 4 shows the relative weight of each one of the 25 chapters examined here. The indices correspond to the situation at the beginning and end of the period (1969-1974) and to the accumulated value for the six years covered by the study.

If, for the purpose of the analysis of concentration, we take as significant chapters those which contain at least 5% of total industrial exports 20/, it will be seen that the 25 chapters which make up the percentage distribution of Table 4 are reduced to 6, which nevertheless cover three quarters of the whole.

20/ The measure of significance adopted is arbitrary, and coincides with 0.5% of the total exported by the country in 1969, or 1% for 1974.

Table 3. Growth of relatively Sophisticated Industrial Exports according to chapters of the NADE Nomenclature
(millions of dollars)

Chapter N°	Products	Exports						
		1969	1970	1971	1972	1973	1974	1969-74
27	Fuels and products distilled from them	5,8	7,6	8,7	6,2	5,5	12,3	46,1
28	Inorganic chemical products	3,1	3,5	2,9	4,0	6,2	10,9	30,6
29	Organic chemical products	13,9	15,7	13,2	16,7	21,0	35,2	115,7
30	Pharmaceutical products	6,2	7,4	7,8	7,6	10,7	14,5	54,2
33	Oils, resins and Cosmetics	1,5	2,0	2,4	3,3	5,1	6,0	20,3
37	Photographic and cinematographic products	3,4	2,1	2,0	2,6	3,8	4,0	17,9
38	Misc. chemical products	1,2	2,2	2,1	3,5	4,4	7,0	20,4
39	Plastic materials and their manufactures	3,3	3,0	3,3	5,0	8,1	6,8	29,5
40	Natural or synthetic rubber and their manufactures	8,4	7,8	5,5	6,8	11,9	26,8	67,2
48	Paper, cardboard and their manufactures	2,1	1,8	2,8	4,4	14,3	34,3	59,7
49	Stationery and graphic arts	19,6	15,0	14,1	16,9	24,4	25,0	115,0
51	Synthetic and artificial textiles	1,9	0,9	1,3	2,1	7,2	3,7	17,1
56	Batch synthetic and artificial textiles	-	0,3	0,9	1,3	0,9	1,1	4,5
73	Iron and steel and their manufactures	28,8	33,1	39,6	44,9	124,2	161,1	431,7
74	Copper and its manufactures	0,4	0,5	0,5	1,1	2,7	2,6	7,8
76	Aluminium and its manufactures	0,3	0,5	0,6	0,6	2,4	3,9	8,3
82	Machine - tools	2,1	2,7	5,5	8,2	6,7	7,5	32,7
83	Miscellaneous metal manufactures	0,6	1,1	0,7	0,8	1,3	2,6	7,1
84	Boilers, mechanical equipment and appliances	33,6	47,0	55,5	69,4	119,0	164,5	489,0
85	Electric and electronic machines and appliances	7,7	7,6	7,9	13,0	29,5	43,2	108,9
86	Vehicles and materials for railways	0,6	0,3	-	-	-	1,8	2,7
87	Vehicles, cars, tractors	9,3	11,4	18,9	35,2	103,6	158,6	337,0
90	Optical and precision instruments	2,5	2,5	3,0	3,6	7,2	8,9	27,7
91	Watches and clocks	0,2	0,2	0,3	0,2	0,7	0,9	2,5
92	Sound and image appliances	0,6	0,6	0,8	1,1	1,9	2,2	7,2
	Total	157,1	176,8	200,3	258,5	522,7	745,4	2 060,8

Source: Instituto Nacional de Estadística y Censos, Anuario de Comercio Exterior.

Table 4. Percentage Share by Chapters of Industrial Exports.

1969-1974

Chapter Nº	Products	1969	1974	1969-74
27	Fuels and products distilled from them	3,7	1,7	2,2
28	Inorganic chemical products	2,0	1,5	1,5
29	Organic chemical products	8,8	4,7	5,6
30	Pharmaceutical products	3,9	1,9	2,6
33	Oils, resins and cosmetics	1,0	0,8	1,0
37	Photographic and cinematrographic products	2,2	0,5	0,9
38	Miscellaneous chemical products	0,8	0,9	1,0
39	Plastic materials and their manufactures	2,1	0,9	1,4
40	Natural or synthetic rubber & their manufactures	5,3	3,6	3,3
48	Paper and cardboard and their manufactures	1,3	4,6	2,9
49	Stationery and graphic arts	12,5	3,4	5,6
51	Synthetic and artificial textiles	1,2	0,5	0,8
56	Batch synthetic and artificial textiles	-	0,2	0,2
73	Iron and steel and their manufactures	18,3	21,6	21,0
74	Copper and its manufactures	0,3	0,4	0,4
76	Aluminium and its manufactures	0,2	0,5	0,4
82	Machine-tools	1,3	1,0	1,6
83	Miscellaneous metal manufactures	0,4	0,3	0,3
84	Boilers,mechanical equipment & appliances	21,4	22,1	23,7
85	Electric & electronic machines & appliances	4,9	5,8	5,3
86	Vehicles & materials for railways	0,4	0,2	0,1
87	Vehicles, cars, tractors	5,9	21,3	16,4
90	Optical and precision instruments	1,6	1,2	1,3
91	Watches and clocks	0,1	0,1	0,1
92	Sound and image appliances	0,4	0,3	0,4
	Total	100,0	100,0	100,0

Source: Instituto Nacional de Estadística y Censos, Anuarios de Comercio Exterior.

Table 5. Percentage Share by Chapters of Industrial Exports
(significant chapters)

Chapter N°	Products	1969	1974	1969/74
29	Organic chemical products	8.8	4.7	5.6
49	Stationery and graphic arts 21/	12.5	-	5.6
73	Iron and Steel and their manufactures	18.3	21.6	21.0
84	Boilers, mechanical equipment & appliances	21.4	22.1	23.7
85	Electric & electronic machines & appliances	4.9	5.8	5.3
87	Vehicles, cars, tractors	5.9	21.3	16.4
	Total	72.8	75.5	77.6

Source: Instituto Nacional de Estadística y Censos, Anuarios de Comercio Exterior.

As arises from Table 5, six chapters cover 72.8% of manufactured exports in 1969. This significant degree of concentration tends to increase, since in 1974 five chapters include 75.5% of all these exports.

For the period as a whole only six chapters exceed the selected measure of significance, and these represent 77.6% of the total value of exports.

The second subject of interest is reflected in Table 6 and refers to the individualization of these chapters which show a faster growth rate than the average of the universe studied, independently of their relative share in the total. Nine chapters grow four or more times between 1969 and 1974, and do so almost without interruption.

21/ Note that although Chapter 49 (Stationery and Graphic Arts) exceeds the significance measure for the 6 years as a whole, its share drops towards the end of the period, to such an extent that it does not appear in the table.

Table 6. Industrial Exports which show highest growth rates,1969-1974

(millions of dollars)

Chapter N°	Product	Exports					
		1969	1970	1971	1972	1973	1974
33	Oils, resins and cosmetics	1.5	2.0	2.4	3.3	5.1	6.9
38	Miscellaneous chemical products	1.2	2.2	2.1	3.5	4.4	7.0
48	Paper & cardboard & their manufactures	2.1	1.8	2.8	4.4	14.3	34.3
73	Iron & steel & their manufactures	28.8	33.1	39.6	44.9	124.2	161.1
74	Copper and its manufactures	0.4	0.5	0.5	1.1	2.7	2.6
76	Aluminium and its manufactures	0.3	0.5	0.6	0.6	2.4	3.9
84	Boilers,mechanical equip. & appliances	33.6	47.0	55.5	69.4	119.0	164.5
85	Electric & electronic machines & appl.	7.7	7.6	7.9	13.0	29.5	43.2
87	Vehicles,cars, tractors	9.3	11.4	18.9	35.2	103.6	158.6

Source: Instituto Nacional de Estadística y Censos, Anuarios de Comercio Exterior.

It is obvious that some of these sectors start from a very low export base and therefore their important relative growth is rather exaggerated. Nevertheless, it is important to keep them in mind and follow their future development, since they may reach significant absolute values in the not too distant future.

Note also that with very few exceptions (Chapters 29 and 49) the chapters in which the greater part of industrial exports are concentrated (Table 5) are also those which show the fastest growth (Table 6). The conclusion can be drawn that manufacturing exports tend to be concentrated in four specific industrial sectors, whose overseas sales show high growth rates, and which cover two thirds of the overall manufacturing export trade in the 1969-1974 period. These sectors are: a) pig iron and steel (Chapter 73); b) boilers, mechanical equipment and appliances (Chapter 84); c) electric and electronic machines and appliances (Chapter 85); and d) vehicles, cars, tractors (Chapter 87).

IV. EXPORT BEHAVIOUR AT COMPANY LEVEL

1. Characteristics of the Sample

Having concluded the prior overall diagnosis - which gives a general view of Argentina's manufacturing exports - the analysis moves to the micro-economic level in order to detect the most significant features of company behaviour in this area. In order to do this, we have examined the development of a sample made up of 20 large firms which stand out as exporters and which represented (according to the product classification adopted in the previous section) 35% of accumulated industrial exports between 1969 and 1974, and 5% of the country's total exports during the same period.

Within the framework of this sample we shall try to identify and study those variables which turn out to be the chief determining factors of export capacity.

The sample consists of the 20 major exporters of industrial products in 1969. The list comes from statistical data of the Administración Nacional de Aduanas 22/. These companies are representative of four clearly defined industrial sectors: Vehicles and Transport Equipment, Chemicals, Machinery and Equipment, Iron and Steel. In other words, this sample adequately overs the chapters which the previous section has identified as of major interest.

Table 7 shows that the majority of the companies which make up the sample are foreign. This raises a number of questions which will have to be examined in subsequent extensions of the present research.

In fact, 16 of the 20 companies studied are local subsidiaries of multinational corporations. A clear numerical preponderance of American firms can be observed (nine), followed to a lesser extent by Italian enterprises (three) and Dutch (two). However, the percentage share by origin of the companies in the accumulated export values between 1969 and 1974 does not reflect the same pattern of distribution, since the Italian companies practically equal

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22/ It must be borne in mind that the sample is made up of the companies which rank as the 20 leading exporters in 1969, not each year. Therefore, we do not know whether the companies included maintained their position in the first 20 during the subsequent years analysed.

Table 7. Companies which Make Up the Company Sample of Biggest Exporters in 1969

	Company	Sector	Origin of parent company
1.	Fiat	Vehicles and transport equipment	Italy
2.	Mercedes Benz	Vehicles and transport equipment	West Germany
3.	Ford Motor	Vehicles and transport equipment	United States
4.	General Motors	Vehicles and transport equipment	United States
5.	Citroën	Vehicles and transport equipment	France
6.	Esso	Petrochemicals	United States
7.	Pasa Petroquímica	Petrochemicals	United States
8.	Squibb	Chemical-pharmaceutical	United States
9.	Cyanamid	Chemical-pharmaceutical	United States
10.	Compañía Química	Chemical	Argentine
11.	Ducilo	Chemical	United States
12.	Olivetti	Office & Accounting equipment	Italy
13.	IBM	Office & Accounting equipment	United States
14.	Roque Vassalli	Agricultural machinery	Argentine
15.	Siam di Tella	Non-electrical machinery	Argentine
16.	Papesa	Electrical & electronic products	Netherlands
17.	Philips	Electrical & electronic products	Netherlands
18.	Standard Electric	Communications equipment	United States
19.	Acindar	Iron and steel	Argentine
20.	Dálmine Siderca	Iron and steel	Italy

Source: Administración Nacional de Aduanas.

Table 8. Accumulated Exports according to Nationality of the Company 1969 - 1974

	Company Origin	Number of Companies	Accumulated Export Percentage in the Period
1.	United States	9	34.9
2.	Italy	3	33.0
3.	West Germany	1	8.1
4.	Netherlands	2	3.8
5.	France	1	3.0
	Total Foreign Firms	16	82.8
6.	Argentine	4	17.2
	Total	20	100,0

Source: Drawn by authors.

the American ones.

In a recent paper J. Sourrouille has estimated the foreign share in 1972 overall manufacturing output as of the order of 31.0% 23/. Judging from the figures in Table 8 the share by foreign companies in exports of manufactured products would be much higher than that which they hold in manufacturing production as a whole. If this observation arising from the data taken from the sample were in fact possible to generalize to industrial exports as a whole, one could think of two situations. The first would confirm the large share of foreign companies in the most dynamic branches of the manufacturing sector, since our definition of relatively sophisticated industrial products only includes products of these branches. Secondly, it could be assumed that access to export business is basically associated with knowledge of the international market, an aspect in which the multinationals have a clear advantage.

The high degree of concentration and participation of foreign firms in export activity can be viewed from another angle in Table 9, which shows that the four larges companies in the sample controlled about 50% of the accumulated industrial exports during the period. Only one of these companies is Argentine.

2. Results Obtained in the Field Study

During the course of this research, contact was made with the export managers and the directors of the engineering departments of the selected companies. In the first case information was collected about variables such as: a) annual volume of exports in the period 1969-1974; b) reimbursement rate connected with them; c) destination; d) composition of exports with regard to finished products, semi-finished articles and parts; finally, e) proportion of sales made to associated companies overseas.

With regard to variables which indicate technological performance, information has been compiled connected with the accumulated flow of expenditure on R&D activities and other associated technical tasks (quality control, maintenance, etc.), carried out in

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23/ Juan Sourrouille: El impacto de las empresas multinacionales sobre el empleo y los ingresos: el caso argentino, ILO, Geneva, 1976.

Table 9. Export Performance of the 20 Companies Shown in Table 8, 1969-1974
(thousands of dollars)

Section	4 Largest Companies	8 Largest Companies	20 Largest Companies
Average Exports Per Company (FOB value)	79 975,3	63 405.9	36 181.2
Accumulated Export Value of the Group	319 901.0	507 247.0	723 623.0
Number of Argentine Companies in the Group	1	1	4

Source: Companies consulted and Administración Nacional de Aduanas.

the plant by each of the companies throughout the period 1960 - 1968 24/.

Putting together the empirical evidence related to these two subjects has enabled us to investigate the sequential relationship between the process of learning and technological improvement experienced by the companies throughout the sixties and their export performance during the first half of the following decade. The results of this association between the rate of technological change and the accumulated volume of exports must be interpreted in the light of the central hypothesis previously set out in this paper.

Volume of Exports

In Table 10 the data on volume of annual exports per company are summarized. In it the companies have been placed in decreasing order, according to their accumulated volume of sales abroad in the period 1969-1974. We can observe a high degree of mobility in ranking when we compare these with 1969 data 25/. As will be seen

24/ Jorge Katz, op. cit., Chapters IV and V.

25/ Note, as an example, the placing of Mercedes Benz (from 19th place in 1969 it moves to 6th for the whole period); on the contrary, Standard Electric moves from 11th to 19th place.

later, this mobility is linked to the loss of relative importance of some industrial sectors in favour of others.

It is appropriate to make some methodological observations on the way Table 10 was prepared 26/.

a) In the cases in which information was obtained in Argentine pesos, an average exchange rate for the year was used for the purpose of stating the value of exports in dollar terms.

b) When it was impossible to obtain the total amount of exports for particular years, we decided to estimate it as the halfway point between those years for which we had precise information (only six observations have been estimated in this way; see those marked with a single asterisk).

So far it has been seen that industrial export activity shows a high degree of concentration in a few chapters of the tariff nomenclature. It has also been seen that 20 companies active in the export sector cover a considerable part of total industrial exports. Table 10 shows finally that the degree of concentration by company is also important within the sample, since the five biggest exporters in it (taking aggregate values from 1969 to 1974) represent 50% of the total volume.

26/ It should be pointed out that in its original version this table included a column for each year, which showed the rate of reimbursement received per company. This rate was calculated taking into account only repayments, or reimbursements and drawback, and excluding all other tax benefits granted to exporters. The average of the reimbursement rates per company throughout the period 1969-1974 ranged from values of 8% (tartaric acid) to 41% (seamless steel tubes), the highest rates corresponding to the iron and steel sector and to vehicles and transport equipment (between 30% and 40%). However, we considered it convenient to leave this data out in this version, because, presented in this way, they allowed no conclusions to be drawn about the effect of reimbursements on exporting. Since export benefits have acted in the Argentine case as exchange rate adjustment mechanisms, to submit the variable to some kind of test it becomes necessary to go into the analysis of effective exchange rates by products and by years, a task which is outside the scope of this first monograph. There is no doubt that this task must be undertaken in the future in order to determine the consistency of the "export benefits" variable as an explanatory variable for the flow of manufactured exports.

Table 10. Total Exports per Year, 1969 - 1974

(thousands of dollars)

Company	1969	1970	1971	1972	1973	1974	Accumulated Exports
1. Olivetti	8 514	13 035	16 102	16 003	18 059	18 961	90 674
2. Acindar	5 003	4 350	3 698	7 496	38 917	21 761	81 225
3. Fiat	1 374	1 380	5 072	10 660	25 681	36 901	81 068
4. Dalmine	8 479	8 442	7 108	8 984	11 969	21 952	66 934
5. IBM	6 913	7 215	7 299	7 502	13 904	20 038	62 871
6. Mercedes Benz	863	1 586	839	11 531	19 792	23 809	58 420
7. Ford	2 694	1 441	2 301	1 218	6 642	19 408	33 704
8. Esso	4 800	5 029	6 698	4 195	4 192	7 437	32 351
9. Pasa Petroquímica	6 159	4 494	4 434	3 254	4 699	8 367	31 407
10. General Motors	954	1 346	2 664	3 503	4 894	8 875	22 236
11. Citröen	1 250	1 894	4 182	5 812	3 452	5 329	21 919
12. Squibb	3 216	3 049	3 207	3 674	3 066	4 753	20 965
13. Cyanamid	1 458	2 805	2 754	3 101	4 396	5 991	20 505
14. Roque Vassalli	1 268	1 676	1 169	2 917	3 490	6 361	16 881
15. Ducilo	2 568	1 790	1 673	3 024	5 178	2 159	16 392
16. Siam di Tella	1 695	2 534*	2 534*	2 534*	3 374	3 200	15 871
17. Fapesa	1 087	1 587	1 714	3 152	4 590	3 491	15 621
18. Philips	1 145	1 366	1 452	1 647	2 413	4 323	12 346
19. Standard Electric	1 369	1 230*	1 230*	1 092	2 912	4 198	12 031
20. Compañía Química	864	1 256	1 247	1 305	1 584	3 946	10 202
Totals	61 673	67 505	77 377	102 604	183 204	231 260	723 623

Source: Plant visits and Administración Nacional de Aduanas.

Table 11. Inter-industry composition of the Sample
1969 - 1974
(Percentages. Total 100)

Sector	Subsector	Company	1969		1974		Accumulated 1969-1974	
Vehicles and Transport Equipment	1.1.	1.1.1. Fiat	2,2		16,0		11,2	
		1.1.2. M. Benz	1,4		10,3		8,1	
		1.1.3. Ford	4,4		8,4		4,7	
		1.1.4. GM	1,5		3,8		3,1	
		1.1.5. Citroën	2,0	11,5	2,3	40,8	3,0	30,1
Chemicals	2.1. Petrochemicals	2.1.1. Esso	7,8		3,2		4,5	
		2.1.2. Pasa	10,0		3,6		4,3	
			17,8		6,8		8,8	
	2.2. Pharmaceutical	2.2.1. Squibb	5,2		2,0		2,9	
		2.2.2. Cyanamid	2,4		2,6		2,8	
			7,6		4,6		5,7	
	2.3. Industrial	2.3.1. Cía. Química	1,4		1,7		1,4	
			1,4		1,7		1,4	
	2.4. Textile	2.4.1. Ducilo	4,2		0,9		2,3	
			4,2	31,0	0,9	14,0	2,3	18,2
Machinery	3.1. Office and accounting equipment	3.1.1. Olivetti	13,8		8,2		12,5	
		3.1.2. IBM	11,2		8,7		8,7	
			25,0		16,9		21,2	
	3.2. Non-electrical	3.2.1. R. Vassalli	2,0		2,8		2,3	
		3.2.2. S. di Tella	2,7		1,4		2,2	
			4,7		4,2		4,5	
	3.3. Electrical, electronic & communications	3.3.1. Fapesa	1,8		1,5		2,2	
		3.3.2. Philips	1,9		1,9		1,7	
		3.3.3. Standard Electric	2,2		1,8		1,7	
			5,9	35,6	5,2	26,3	5,6	30,3
Metallurgical	4.1.	4.1.1. Acindar	8,1		9,4		11,2	
		4.1.2. Dálmine	13,8	21,9	9,5	18,9	9,2	20,4

Source: Own data obtained from plant questionnaires.

The base information contained in Table 10 allows the study to be carried to the inter-industrial level. To this end Table 11 reorders this information by industrial sectors of the CIIU classification at the 4-digit level of aggregation; note that only four branches of industry are included in the sample. They are: 1) Vehicles and Transport Equipment, 2) Chemicals, 3) Machinery and Equipment, and 4) Iron and Steel Products.

With the exception of the chemical sector, the remainder are representative of Chapters 73, 84, 85 and 87 of the NADE nomenclature, which, as has been pointed out, cover two thirds of total industrial exports.

Table 11 also shows the development of the relative share of each sector in the overall sample between 1969 and 1974. The most important variations observed are those described below.

One: Vehicles and Transport Equipment is the only sector in the sample which increases its relative share. Not only is it the only sector which grows, but it does so in a very conspicuous way, almost quadrupling its initial percentages. This means that all the other sectors lose ground in its favour (in the case of Iron and Steel only slightly). Fiat and Mercedes Benz show surprising growth, being for this reason the companies which have the most positive effect on the general development of the sector's position, although Ford and General Motors also double their share in 1974 in relation to the base year. However, theirs is a pale reflection of the remarkable performance attained by the two European companies.

Two: the Chemical sector is the one which loses its share most markedly, since its coefficient is reduced to less than half its original value. This strong relative fall is mainly due to the loss in importance of the petrochemical and textile branches - Esso, Pasa and Ducilo - and to a considerably lesser extent to what happens in the pharmaceutical area, where Squibb's initial position is weakened.

Three: the loss of relative importance of the Machinery and Equipment sector is shown almost exclusively by the variations in the Office and Accounting Equipment subsector. While the two exporters which represent this subsector in the sample - IBM and Olivetti - suffer a marked percentage reduction, the other branches (Electrical and Non-electrical Machinery) maintain their share at practically the same levels.

Exported Products: Characteristics and Destination

Appendix I includes tables which give details of the products exported by the companies analyzed, describe their characteristics and list the markets to which they are shipped.

Table I-1 provides additional evidence of the degree of concentration observed in the export of products which have been described as "relatively sophisticated". In this table we present the percentages resulting from relating the amounts exported by each company with the total value of exports dispatched during the period in each one of the chapters of the NADE nomenclature corresponding to the main products which the companies sell abroad. From these percentages it follows that the relative share of the companies in the sample with respect to the total amount exported in each chapter (in some cases two) has in no case been below one third. In some cases the percentages are much higher, as with Esso which covers 70.3% of the exports of oil derivatives which make up Chapter 27.

Tables I-2 and I-3 show the data referring to the geographical destination of the exports. The first consists exclusively of a division into two large groups, while the second describes the destination of exports by countries. The distinction in Table I-2 between LAFTA and the rest of the world is intended to measure the importance assumed by the free trade area for exports of this kind. The figures collected confirm a priori expectations that the general tendency by the majority of the companies is to export sophisticated manufactures exclusively within the LAFTA area.

However, there are some exceptions worth mentioning. On the one hand, there are a few companies for which the outside market is very important. Examples of this situation in the sample are IBM, Squibb and Siam di Tella.

Secondly, it can be seen that the importance of the market outside grows considerably as time goes on for a number of other firms, among which we can cite Acindar, Fiat, General Motors and Cyanamid.

In view of these two circumstances, it seems reasonable to expect that manufacturing exports to non-LAFTA markets can eventually evolve into significant figures in the future.

Part of the explanation of this process may lie in the new forms of industrial integration which some multinational corporations are currently carrying out. These have been described by

G. K. Helleiner 27/, even though this author attributes much of what has happened in this respect to relative differences in labour costs. We have found some cases - which are illustrated in the following section - in which the capability for entering into overseas markets might be explained by a rapidly increasing level of efficiency which allowed the companies to move beyond the LAFTA frontiers as they did not need to depend on high levels of protection 28/. The possibility should not be rejected either that learning aspects in the area of international marketing have some connection with access to markets outside the area 29/.

Finally, in Table I-4 exports are divided into finished products and parts. In general, the tendency to export finished products prevails, although in some cases (for example, automobile companies) the export of parts is relatively important. These exports are geared to the normal replacement of spare parts of equipment previously sold, and also relates to the integration strategy of multinational firms, which in the case of Latin America is associated with agreements concluded within the framework of the LAFTA.

27/ G. K. Helleiner, op. cit.

28/ David Felix attributes importance to the LAFTA tariff concessions as explaining industrial exports within the area: "to be sure, LAFTA tariff concessions affect price/cost ratios, but they also operate to reduce risk, since they give access to a regional market protected by high third-country tariffs against full competition from advanced country suppliers, and since intra-LAFTA competition has been restrained by the tendency of member countries to concentrate their concessions on noncompetitive imports". See David Felix: "Industrial Structure, Industrial Exporting, and Economic Policy" in D. Gerthman (ed.): Fiscal Policy for Industrialization and Development in Latin America, Florida Press, 1974, p.299.

29/ These considerations do not mean we ignore the importance which manufactured exports to Cuba assumed in 1973-1974. This export expansion to this non-LAFTA member Latin American country has occurred within the framework of a broad trade treaty signed by the two countries, and it has doubtlessly to some extent distorted the data on exports outside the area in some industrial sectors in particular; for example, the automotive industry.

V. EXPORT BEHAVIOUR: A DESCRIPTIVE SUMMARY

The previous sections of this paper have attempted to give a general idea of the development of Argentine exports of relatively sophisticated manufactures. Their rapid growth, their strong concentration in a few dynamic sectors and, within these, in a very few firms of relatively large size, the remarkable share in the export business of a group of local subsidiaries of multinational corporations, etc., are features which characterize this process, as has been indicated by the empirical evidence presented so far.

In this section we pursue a double objective. On the one hand, it is a matter of examining the information so far presented in the light of our initial hypotheses. Even though at the present stage of research it is difficult to carry out a strong quantitative test of it, we consider it important to begin to develop alternative methodologies to study the relation between the flow of manufacturing exports and those other variables indicative of technological performance. Especially representative would be the accumulation of industrial experience at company level, and also the performing of systematic research and development activities, directed at designing new processes or products, or at the gradual improvement of already existing ones. These subjects have scarcely been examined by the recent literature on Latin American industrial exports, it being the authors' aim to open the debate on this topic.

On the other hand, the relation between variables of a technological nature and the export performance cannot be studied while ignoring the general framework in which the flow of external trade takes place, and which is influenced by many variables. In this direction, we shall attempt to suggest broader lines of research which could be tackled in the future.

The two objectives stated tend to complement each other, since, as was pointed out, we still lack a conceptual framework which would bring together those variables which are relevant to explain the manufacturing export phenomena. Among these explanatory variables lies the hypothesis that relates the export performance of the main firms active in this area with their increasing production efficiency over time, and with their systematic technological activities regarding the adaptation and improvement of imported

technologies or the generation of domestic technologies 30/.

The data presented in the first part of this section comes from a field study which included visits to the 20 companies which make up the industrial sample examined in previous sections. In each case personnel from the export department and engineers and technicians from the engineering departments have been interviewed; with them it was possible to evaluate the technological activity carried out by each firm. Perhaps the main fact which surprises anyone attempting a micro-economic study of this kind is the enormous heterogeneity of cases and situations encountered in practice. The conceptual models which are usually employed in this field rarely allow the degree of multicausality which it has been possible to detect throughout the plant interviews made by us. For this reason, and for the purpose of initiating the present study,

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30/ In an interesting paper D. Felix has analyzed Argentine industrial exports between 1959 and 1968, taking into consideration the following explanatory variables: i) the effective exchange rate, for which he took account of the nominal exchange rates, plus reimbursements; ii) idle manufacturing capacity; and iii) tariff concessions within the LAFTA framework. His results attribute little importance to the exchange rate, or to the reimbursement rate as an explanation of the export flow, emphasising the existence of idle capacity and intra-LAFTA trade. Even though we believe that the variables used are clearly significant, we think that Felix's conclusions are not necessarily applicable to what happened after 1969, a period in which the growth of industrial exports expanded quite rapidly.

For example, it must not be forgotten that Felix's data refer to a period in which the incentive mechanisms were much less sophisticated than those in force during the seventies. In the same way, the indicator chosen to study intra-LAFTA trade has not been entirely accurate, since there is no reason why the number of annual concessions negotiated should have any correlation with the trade actually carried on within the area. An example of this is that throughout the seventies the number of concessions negotiated has remained at a standstill, whereas trade has increased very significantly. Felix's work is valuable, however, because it introduced three essential variables which should be studied again at specific product level, and in the light of what has happened in the last few years. In connection with David Felix's article, see: "Industrial Structure, Industrial Exporting and Economic Policy", p.377 in David Geithman, (ed.), Fiscal Policy for Industrialization in Latin America, Florida Press, 1974, p.299.

we thought it appropriate to attempt a description of the various patterns of behaviour detected in the sample.

The following descriptive summaries have been produced putting together both the material obtained in the above-mentioned interviews and the data from the survey on Research and Development Expenditure carried out by one of the present authors for INDEC in 1969 31/.

The variables which determine company behaviour are many, and they usually overlap and interlock, so that it is difficult to isolate the individual effect of each one. To this is added the difficulty entailed in trying to generalize on the basis of individual cases. All the companies have peculiarities, but we have tried to ignore some of them in order to group together those examples in which we can find attitudes or determining factors which are basically similar. In this way we hope to be able to throw some light upon company strategies in the export field. Among the 20 companies studied, we have distinguished six different patterns which we describe below:

Group I: Olivetti, IBM, Citroën

These are companies whose local production and export programme forms part of a more general plan of international division of labour designed by the parent company. The Argentine subsidiary's production is linked with the activity of the parent company itself or with any other subsidiaries within the group. In every case in which this linking occurs in the Latin American area, the Argentine subsidiary seems to specialize in those items which are technologically more sophisticated; that is, those which require a larger engineering content. This assignment of tasks is not unconnected with the relative abundance of technically skilled labour in the country, and therefore with its relative price. In fact, the relative availability of skilled resources in different Latin American countries would seem to constitute precisely the factor which decides the pattern of geographical location of products and pro-

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31/ Encuesta sobre Gastos en Investigación y Desarrollo para las 200 empresas de mayor volumen en Argentina, INDEC, Buenos Aires, 1969. The results of this survey appear in: J. Katz, Importación... op. cit., Fondo de Cultura Económica, Mexico, 1976.

cesses within the multinational corporation 32/.

The linkage system of these companies in the Latin American context has been encouraged by some mechanisms in force within LAFTA, which these firms have generally signed (IBM is an exception) 33/.

32/ A clear example in this respect is that of Olivetti, a company which manufactures manual typewriters in Mexico, electric ones in Brazil, and accounting machines, telex and computer equipment in Argentina, thus exploiting the relative advantages deriving from a more developed local industry in parts and components, and also those arising from the greater relative abundance of skilled labour.

33/ The Complementarity Agreements are mechanisms which were foreshadowed in the Treaty of Montevideo, and which really prospered towards the end of the sixties and the beginning of the seventies. In fact, these agreements have their origin in the so-called Sector Meetings, in which the firms concerned participate directly and submit a complementarity blueprint to their respective governments so that they may take it to the Permanent Executive Committee of LAFTA. The agreements involve a lifting of duties on the specific goods considered in them, which creates a tendency to company specialization by group of products. The agreements are an exception to the most favoured nation clause in the LAFTA negotiations (resolution No. 99), the advantages stipulated being applicable to the parties involved and only to relatively less developed countries. Much of what has occurred with respect to trade expansion in manufactures in recent years has been attributed, in the LAFTA countries, to the effect of complementary trade. However, when one looks at the figures for trade deriving from the agreements within the overall intra-LAFTA trade, the fact emerges that these are not significant in terms of value. That is, that even though the Complementarity Agreements are clearly significant as regards the characteristics of the goods traded, they are not so from the point of view of the volume of trade. Thus, for example, for 1972, aggregate imports corresponding to the Complementarity Agreements (excluding Uruguay, for which data are not available) reached 80.8 million dollars out of a total of intra-area imports of 1,664 million dollars. This ratio, which represents approximately 0.5% of intra-area trade, is maintained for the years studied, with a calculated slight increase towards 1974-1975. The authors thank Roque Carranza and Roberto Tomasini for their valuable comments on this point.

The variance in the technological performance of the companies included in this group should be noted. While Olivetti and Citroën tend to modify to a lesser extent the design and characteristics of their products, IBM carries out a significant technical effort within the country, both regarding process engineering and product development. These technical activities have given rise to various technological successes which were of interest to the corporation as a whole 34/.

It is interesting to note that this successful technological performance has led to an important change in the role the Argentine subsidiary has been playing within the IBM group as a whole. Initially, the plant was designed for assembling and repairing obsolete equipment, which was imported temporarily from where it was being employed, and then re-exported. This activity was closely connected with the exploitation of domestic labour skills in the same way that Olivetti does; it even included repairs which involved semi-craft inventiveness that goes well beyond purely standard skills. Subsequently, the company gradually acquired experience in the design of new parts for equipment of latest vintages, parts which it specialized in producing with the aim of supplying other IBM subsidiaries in Sweden, Japan, Canada, etc. It must be emphasised that, unlike the other two companies which make up this first group, IBM of Argentina links its production programme with that of subsidiaries of more developed countries, and tends to give less priority to LAFTA, a fact which can be attributed both to the inherent characteristics of the goods produced, which are not in great demand in the Latin American market, and also to their technological level.

Finally, it is appropriate to point out that, in spite of the fact that these companies have been operating in the country for a long time, their manufacturing plants belong to the most recent wave of foreign capital inflows, dating from the early 1960's; they are, therefore, relatively new establishments within the Argentine industrial environment.

34/ At the end of the last decade, of a staff of somewhat below 500 the IBM manufacturing establishment employed approximately 20 engineers and just over 100 technicians. Of the successful domestic technological developments, three were mentioned during the plant visit: the perforator plates, the 029 printer, and the carbonitrate process.

Group II: Philips, Papesa, Standard Electric, Cyanamid

The firms in this second group - like those in the previous one - also link their export plans with a multinational programme designed by their respective headquarters; to do this they make use of the advantages of complementarity agreements and other exemptions of the free trade area, since almost all their exports go to the LAFTA market.

However, they stand out from the previous subgroup because of a fact related to their production capacity rather than to their export style: these companies have a very large internal market for their products. In relative terms it is considerably bigger than the one catered for by the firms described in the previous section, and this has allowed them to operate locally with relatively more efficient scales of production. To this they have added a good technical engineering staff, which has permitted them to gradually reduce their working costs by the introduction of improvements in operating routines, or modifications in product designs originating in their parent companies.

Examples of these companies are Cyanamid and Philips. The former has locally specialized in medical products for veterinary use, while at the same time the Brazilian subsidiary has gone to a greater extent into the area of antibiotics for human use, probably bearing in mind the greater scale of Brazil's potential market in this last respect. Intra-company trade is carried out on the basis of this specialization in various locations. Philips, on the other hand, has locally specialized in electric shavers, bearing in mind the high level of penetration of this product in the Argentine market, certainly the largest market in Latin America 35/ thus far.

To sum up, the companies in this group differ from those of the previous one basically because they operate with adequate plant scales for efficient production.

Group III: Compañía Química, Esso, Pasa

The exports of this subgroup are those which could most

35/ Philips produces approximately 1,000,000 units annually in its shaver plant, a volume which it is assumed is adequate for exploiting economies of scale.

clearly be fitted into the assumptions of the received theory of international trade, according to which comparative advantages arise from the exploitation of an abundant, and therefore relatively cheap, natural resource. However, at the same time they show that not in every case does the low relative price of a natural resource arise from its abundance. The low cost may originate in subsidized internal costs, as occurs in the present case with certain products derived from petroleum production, in which the export capacity comes from administered prices of basic raw materials which do not necessarily reflect the opportunity cost of the resources at the overall level.

Compañía Química is the most typical example of this group. Its basic export - tartaric acid - is a by-product of the wine industry. Its production is restricted to those countries which have an ample production of wine grapes. Technologically, the product in question can be considered relatively mature. It is produced locally with a widely known technology, in which only recently have any interesting changes in the state of the art on a world scale been observed, as the result of the appearance of a synthetic substitute 36/.

The development of the latter could affect the competitive capacity of local production in the medium term, by eliminating the advantage arising from the abundant natural resource. In the same way, the other petrochemical items which make up this group could also see their competitive position reduced in the medium term, if the country moves towards a less subsidized structure of basic raw material prices.

Also in the group, remarkable differences with respect to the level of technological efforts carried out by each company can be observed. Such efforts vary from levels like that of Compañía Química which, as has already been pointed out, operates with a widely known and relatively obsolete technology, to Pasa Petroquímica Argentina, a company which already towards the end of the

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36/ German and Japanese firms seem to be attempting to replace natural tartaric acid with an enzyme-based synthetic product. The opinion has been gathered, however, that these technologies would not be very popular because of their highly pollutant nature, which would prolong for several more years the existence of conventional technologies. With regard to the latter, it would seem that Duperial Argentina has introduced substantial technological improvements into basically well-known processes.

last decade had a highly qualified professional department which carried out a significant R&D programme 37/.

Group IV: Acindar, Dalmine Siderca, Roque Vassalli, Siam di Tella

The firms which make up this subgroup are perhaps the most interesting cases of success in the area of what has traditionally been called "infant industries".

In fact, with the exception of Dalmine, they have all been operating for several decades in the local market, having begun their activities in the early stages of import substitution in Argentina. The viability of the import substitution programme undertaken in their respective areas was guaranteed by the ample internal market to be supplied (iron for the construction industry, wire for the rural areas, harvesters and agricultural machinery, seamless steel tubes for the petroleum industry, etc.), together with the high existing level of protection. In the first stage, the impossibility of importing during the Second World War and its aftermath acted as de facto protection. Later, high tariff levels were established in agreement with a broad import substitution programme. In both cases, this meant a quasi-monopoly situation in the domestic market. In this respect, it is interesting to point out that three out of the four Argentine companies which make up the sample of 20 firms studied here belong to this group, and are characterised by a definite historical sequence. At the beginning, the size of the internal market, which was practically reserved for them, allowed the establishment of industrial plants of a relatively efficient size, not infrequently based on a large amount of domestic engineering capacity 38/, or on the exploitation of

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37/ Pasa Petroquímica has been operating since 1966 producing synthetic rubber. Of a total of 820 people employed in the company in 1968, 178 carried out technical functions and 51 of these were university-trained professionals. These proportions were already high for the manufacturing standard of the country at that time. From the beginning the company has had a pilot plant for R&D activities and also uses the plant itself for testing operations, prior to the launching of new kinds of rubber on the local market.

38/ The case of Acindar is illustrative when we consider its original design. The rolling mill in the Rosario plant was already

locally developed innovations 39/.

Together with the development of the import substitution process, these companies gradually attained a strong oligopolic position in the internal market. Towards the beginning of the nineteen sixties, these companies began to experiment in the export trade. At this point in their history the firms which make up this group began to realise that they had a significant competitive edge in various Latin American markets. Once exporting had been incorporated into the companies' normal activities, they entered a third stage characterised by their own development as multinationals within the Latin American area. During this stage they have carried out programmes of direct investment, setting up partially or wholly-owned industrial plants. In these plants they exploit proprietary "technological packages" of their own, developed out of their experience in the Argentine market 40/.

The strengthening process of all the firms which make up this group is not unconnected with the fact that they have built up good engineering teams, and operate at present on the international technological frontier in their respective industries.

Thus the companies which make up this group have begun to consider exports as an important variable in their long-term strategies, having overcome the stage in which their exports acted as an

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obsolete at the time of acquisition, and was put into operation only after significant domestic technical efforts. Both the furnaces and the rest of the original steel mill were locally designed and constructed. See the paper by Philip Maxwell: Aprendizaje y cambio tecnológico en la planta Acindar de Rosario, Naciones Unidas, Programa BID-CEPAL de Investigaciones en Temas de Ciencia y Tecnología, Buenos Aires, 1975.

39/ The growth of Roque Vassalli has been based on inventions of their own, like the corn harvesting (1951) or rice harvesting (1962) equipment.

40/ The stages described in the developmental history of these companies are similar to those examined by R. Vernon in his theory of foreign investment based on the "product cycle". See, R. Vernon: "International Investment and International Trade in the Product Cycle", Quarterly Journal of Economics, May 1966, pp.190-207.

occasional complement to their sales in the internal market 41/. Even though initially their interest in exports can be explained by a reduced level of domestic demand 42/, at the present time their capacity expansions have explicitly incorporated as a basic objective a growing volume of exportable goods.

Group V: Fiat, Ford Motor, General Motors, Mercedes Benz, Ducilo

This group is characterised by the fact that it is made up basically of firms which belong to the Vehicles and Transport Equipment sector, having for this reason the greatest quantitative wieght in the sample examined in this paper. All the firms in this group have important domestic engineering teams working on the adaptation of product designs or manufacturing processes received from abroad 43/. These engineering teams have not only worked on the adaptation of foreign 'blue prints', but they have also carried out a significant effort developing local suppliers, designing and

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41/ That the export business now forms part of the long-term strategy of these companies is shown by the fact that many of them have recently created export divisions of considerable size.

42/ Dalmine Siderca installed its plant to supply YPF's demand for seamless tubes in the early sixties. The government elected in 1963 cancelled the exploration and exploitation contracts of private companies, causing a collapse of YPF's investment plan. This sequence of events nearly sent Dalmine bankrupt and forced it to seek external markets, which it did with continued success. Acindar began its exports to neighboring countries in 1960; however, its real effort in this direction dates from 1963, when it was faced with a drastic fall in demand as a result of the recession of 1962-1963. At that time, it began its exports to the United States, a country which has remained as one of its chief sources of demand.

43/ It is surprising to find in some of these plants engineering groups of considerable size. Such is the case with Ford, whose Product Engineering Department had some 200 engineers and technicians back in 1975.

actually producing individual pieces of capital equipment 44/, etc.

Various domestic technological developments have emerged from bottlenecks imposed by the size of the market. To overcome the negative effect of the lack of scale economies, the existing tooling is frequently recycled in uses different from those it was originally designed for. It seems to be the case that the utilisation of domestic technical capacity for this purpose eventually turns out to be more profitable for the companies than completely renewing the equipment, tools, dyes, etc., needed for each new model. At the same time, this engineering activity allows the vehicle to be adapted to the local conditions, which in the end becomes a major advantage for its export to other somewhat similar Latin American markets 45/.

It should be emphasised that until recently cars were not an important export item 46/. Rather, the observed export activity tended to concentrate on utility vehicles, such as trucks, buses, tractors, railway equipment, railway coaches, locomotives, etc., all of which seem to be characterised both by the lesser importance acquired by scale economies in their productive process, and by the high unitary content of skilled labour.

It is worth mentioning explicitly the cases of Fiat and Ford with regard to domestic engineering activity. Fiat exports include predominantly the 619 heavy truck and tractors. In both cases these products are an extremely modified version of the original Italian designs. With regard to trucks, the modifications introduced were made at the request of the Army, which represents an

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44/ The case of Ford Argentina can once more be cited, where technicians design and build most of the testing equipment they use, on the basis of general technical information from the engineering manuals of the parent company.

45/ Thanks to their technical advantages, Ford's locally-redesigned trucks were well accepted in Bolivia and Central America, since they were much better adapted to local conditions than the English substitutes traditionally used in these countries.

46/ The boom in car sales corresponds to the contracts signed with Cuba in 1973, which, unlike the sector's export experience up to that time, required a larger proportion of cars than of utility vehicles.

important source of demand. The tractor also underwent technological modifications, since it had not only to be redesigned because of the ecological peculiarities of the local environment (absence of mountainous geography, of rocky ground, etc.), but it had also to be adapted to working conditions characteristic of extensive farming like those which prevail in large areas of Argentina.

Ford has also stood out in this direction, and an interesting case to examine is that of the Ford Taunus, introduced on the local market. It uses basic engineering developed by Ford's German subsidiary, but in fact the car which is produced in Argentina differs significantly from the German model. The local model was introduced with a lag of nearly two years with regard to the European original, the overall investment in the project being approximately 60 million dollars, of which between 12 and 15 per cent corresponds to the expenditure assigned to engineering development. These engineering efforts required the collaboration of the whole Product Engineering Department throughout 18 months. The basic fact is that the Argentine Taunus does not use the original German engine, but a 4-cylinder engine manufactured in Brazil, which is the same one used in the United States for the Ford Pinto. As the original engine was not to be used, the Taunus required a redesign of various functional systems of the car, there being very few parts of the original design which were not modified 47/.

As arises from the examples described, the companies in this group carry out engineering efforts of some significance, induced to some extent by the rather inadequate scales of operation with which they work in the local market.

Group VI: Squibb

This company is a clear example of exploitation of tax conditions in international trade. Towards the beginning of the fifties, Squibb was the first company to install a chemical fermentation plantation for the production of antibiotics for human use in Latin America. This effort, of considerable scientific importance at that time, was accompanied by the formation of an important technical

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47/ As a result of the use of a different block from the original, the whole transmission system, gear box, etc. had to be redesigned.

and research team. Even though the process engineering department later declined (it was probably too large in its initial stage), it has continued to have a decisive influence on the high levels of manufacturing productivity achieved by this firm.

Exports have always been made within the framework of the corporation as a whole. They are concentrated practically in a single product exported in bulk to Ireland. The Irish Squibb subsidiary receives more than 70% of the foreign sales of the Argentine subsidiary, acting as the intermediate point in a triangular trade arrangement, the final destination of which is the U.S. market. In this case the trade flow - aside from the high local productivity - is strongly associated with the fact that the firm is able to manipulate transfer prices in order to maximize the benefits of trading through a Tax Haven (Ireland).

VI. CONCLUSIONS AND LINES FOR FURTHER RESEARCH

The recent expansion of manufacturing exports from countries of recent industrial development has posed serious difficulties for the theory of international trade. Many theoretical efforts of the last few years have attempted to find a suitable interpretative framework for this new phenomenon, granting greater relevance to variables until recently rejected by received theory. Among these efforts the analysis of the role of technology and its impact on export capacity stands out.

In the first section of this monograph the hypothesis was introduced that the technological variable might be playing a significant role in the explanation of the growing export capacity in manufactured goods on the part of countries like Argentina. After presenting the hypothesis we proceeded to study the experience of 20 companies which stand out as exporters of relatively sophisticated industrial manufactures. The results obtained in this case study suggest that the analysis of the technological variable should be done within a wider framework which would allow us to understand company behaviour in a general context, where technology is one of the intervening factors. It has been noted also that the variables which determine company behaviour are many, and that all seem to play a specific role in the export scenario, although certainly not all at the same time or to the same degree. It is for this reason that any model which tries to attribute explanatory capacity to any one single variable runs the risk of losing contact with reality.

As a corollary to the description of the various patterns of company behaviour, a list has been compiled of those variables detected during out field work. These variables have been grouped into four problem areas. They are:

Exploitation of a Relatively Abundant Resource

The explanation of international trade on the basis of the relative abundance of a factor which it is advantageous to exploit intensively is present in practically every piece of thinking in the area of international trade. Thus, classical theory emphasised the importance of natural resources in the famous Ricardian two factor model - capital and land. For its part, the neoclassical model stressed the relative price of the factors measured as homogeneous capital and non-differentiated labour. In its more recent

forms, the neoclassical theory has been reformulated in terms of the relative abundance of the so-called "neo-factors" of production, such as "technology", "skilled labour", etc.

The field study presented here identifies three different situations which can be assimilated into this "explanation" of the export phenomenon.

1. Advantages derived from the exploitation of an abundant natural resource.

2. Availability of inputs, the prices of which, for reasons of economic policy, are lower than their "equilibrium" price.

3. Employment of relatively cheap skilled labour.

The first item corresponds to the classic case, and therefore requires little comment. The second, is a variation of the previous one, in so far as it refers to the intensive utilization of a natural resource which the private entrepreneur obtains at subsidized costs. (It should be noted that the resulting effect from the point of view of its incidence upon export capacity is similar to that which arises from the exploitation of an abundant, and therefore cheap, natural resource.

Finally, it must be borne in mind what kind of labour is relatively abundant in a given country, since labour cannot be considered as a completely homogeneous factor. In general, attempts have been made to explain the manufacturing exports of the countries which concern us here, giving prime importance to the low cost of labour. Thus, there has been a tendency to view from the same angle situations of the "Taiwan" type or the Mexican "maquila", and the Argentine case, when in fact it is not the same kind of labour which is in abundant supply in these countries. In the Argentine context, for example, technical-engineering labour is relatively cheap, giving rise to the location of more sophisticated forms of production than those which would be expected on the basis of an argument which did not distinguish between different qualities of this factor.

Aspects Related to Production Efficiency

The items included in this topic are connected with the scale of operation and its relation to the likelihood of increasing returns on scale. This variable is not included in the traditional neoclassical view, which argued on the basis of linear and homogeneous production functions, that is, assuming constant returns

on scale. More recently, the neoclassical model has reassessed the importance of this variable.

The scales on which plants located in recently industrialised countries operate depend to a large extent on the size of the respective home markets, and on the way in which the import substituion process was structured. On the other hand, the unprofitable scales on which many of these plants work influence the pace and nature of technological changes actually introduced in any given plant.

Concerning scales of production, the following situations have been observed:

1. Exploitation of scale economies.

2. Expansion of production with the explicit objective of expanding exports in plants essentially built with the idea of supplying demand.

The first case refers to those plants where the scale of production is somewhat close to international standards. Given the way in which the import substitution process occurred in countries like Argentina (directed primarily at the internal market) this has been the least common situation, and has only occurred in those few products for which the internal market was sufficiently developed from the beginning. Unlike these special cases, the import substitution process generally has taken place in terms of inadequate scales of production, either because of the establishment of plants too small to benefit from scale economies, or because of the installation of plants too large with respect to the size of the domestic market, which have operated with a great deal of idle capacity.

The establishment of several plants in any given industry accentuated the impossibility of any one of them taking advantage of scale economies, and at the same time the failure of demand to fulfil growth projections meant that idle capacity remained at high levels for long periods of time.

However, and in a way not initially foreseen, the low utilization of installed capacity was to become an export stimulus, as our second item indicates. In fact, the low level of activity in relation to installed capacity has given the companies the incentive to expand production for exports, allowing them to reduce the average fixed costs which result from operating much below capacity.

Several of the companies hereby studied entered into the export field exactly in this way, and frequently during the course of their

international involvement became aware of their competitive capacity. Once exporting was included in their normal activities, in quite a few cases such exports ceased to be an alternative to sales in the domestic market and have become a stable component of their programme. It is in this stage that decisions to expand productive capacity begin to include export objectives which are quite independent of the fluctuations of the internal market.

Advantages Arising from Technological Knowledge

There have also been attempts to explain manufacturing exports by the so-called "neo-technology" theories of international trade. Among them we can mention the product cycle theory, and that concerning the technological lag between countries. It is interesting to note that up to now this kind of theorizing has been little invoked to explain the case of recently industrialised countries. This monograph has placed special emphasis on the subject of technology, since we believe that the manufacturing experience accumulated by countries like Argentina over the last few decades involves a process of technological upgrading which has greatly influenced efficiency and productivity at the industrial level, and therefore enhanced the likelihood of international competitiveness. This learning process is not unconnected with the accumulated flow of R&D expenditure, basically that intended to improve and/or adapt products and productive processes.

The following situations have been detected in connection with this variable:

1. Technological advantages arising from patents, inventions, etc., originated and developed domestically.

2. Local research and development activities which have given rise to an oligopolic advantage derived from the adaptation and/or improvement of foreign technological designs.

The first item corresponds to the development of products and/or processes of basically local conception, in which foreign technology has only played a monor part. The second one refers to innovations arising from adaptation, improvement and adjustment of technologies essentially developed in other countries.

In both cases the domestic technological activity leads to the rise of a new technological asset capable of generating new profits by means of its international marketing.

Institutional Elements

This subject includes all those aspects of a normative nature which entail a legal instrument, or concrete economic policy measures, tending to encourage export trade. Domestically these institutional aspects take the form of promotional mechanisms intended to modify the propensity to export. Internationally they assume the character of bi-national or regional agreements, such as LAFTA and others.

In the present sample, the following items have been detected:

1. Tax or credit stimuli.

2. Arrangements arising from negotiations among States, or from international agreements.

3. Trade preferences in the LAFTA area.

4. Intra-multinational corporation complementarity agreements.

The first variable listed refers to the mechanisms traditionally used to promote manufacturing exports in countries which are beginning to develop this kind of trade. The second is related to special events connected with international economic negotiations, in which government to government arrangements are established, tending to create a trade flow involving industrial goods. An example of this kind of situation are the agreements signed in 1973 between Argentina and Cuba, which included the equipping of several sectors of the Caribbean country by Argentine industries. Just as the first two variables which have been referred to entail an improvement in the effective exchange rate received by exporters, or the possibility of submitting a better financed proposal than in normal conditions, the last two refer to advantages provided by the LAFTA mechanism.

In short, the information gathered during this study agrees with the results obtained at the macro-economic level by several authors who have investigated the subject of international trade flows. In particular, the authors of this paper agree with the opinions of G. C. Hufbauer who, after carrying out a quantitative study of the trade flows of several countries, trying to test seven different theories of international trade, states: "Retrospectively, we must conclude accepting the fact that the export patterns reflect a lot of different characteristics. No one theory has a monopoly on the explanation as to why a country has the capacity to export manufactures . . . In a certain way, these "different characteristics" only pick up different angles and shades of the

increasing sophistication which accompanies economic development" 48/.

The initial emphasis of this monograph was directed at the examination of the association which exists between export capacity in manufactures and technological variables, such as those representative of learning processes and domestic research and development activities.

At this stage in the investigation, we believe that the link between these variables and the export process is clear, despite the need to explore it in greater detail.

It is, however, true that a comprehensive explanation of the newly acquired export capacity cannot be built round a single variable, whether this is technology or any other. Precisely to emphasise the multiple causes which underlie the export phenomenon we have listed a number of such variables as those referring to the relative abundance of factors, institutional aspects, corporations' strategies at a multinational level, etc., all of which interact to define the pattern of manufacturing exports of any given company and/or country.

What is more, it would seem that all the variables observed would not be sufficient to draw up a theory to explain the increasing export capacity shown by industries like those of Argentina, Brazil, etc., if we do not bear in mind the underlying historical aspects which make up the complex nature of an industrialization process and which are summarised in what Hufbauer calls "shades of the increasing sophistication which accompanies economic development" 49/.

48/ G. C. Hufbauer, op. cit.

49/ Recalling the nature of this study, it is appropriate to present the statistical results obtained when studying the relation between industrial exports of the companies analyzed in the sample, and some variables representative of learning and technological activities. However, given the limited number of the observations which make up the sample, these results are only indicative. The correlated variables were:

1. $\sum_{1969}^{1974} X$ (Exports): this variable arises from the last column in Table Nº 10. It refers to the accumu- value of exports between 1969 and 1974.

2. $\sum_{1960}^{1968} Q$ (Physical volume of production): this is obtained by dividing the value of the annual production of each establishment by the price index of its principal product. It is the value accumulated between 1960 and 1968.

3. $\sum_{1960}^{1968} RD$ (Research expenditure): it consists of the total expenditure on Research and Development efforts, including those directed at "Trouble Shooting" and improvements to be introduced in products and/or processes. It is the value accumulated between 1960 and 1968, taken in per capita terms and deflated by the price index of the establishment's principal product.

As can be observed, the three variables reflect their accumulated value over several years. This contributes to the elimination of the distortions inherent in short-term fluctuations. Likewise, it is assumed in the analysis that the export performance in the first half of the seventies should reflect, with some lag, the accumulated technological efforts of the decade immediately prior to it.

The resulting correlation coefficients were:

	X	Q	RD
X		.67	.27
Q	.67		
RD	.27		

16 observations
15 observations

In addition, the following multiple regression model has also been estimated by least squares:

$$\sum_{1969}^{1974} X = C + \alpha \sum_{1960}^{1968} Q + \beta \sum_{1960}^{1968} RD + E$$

It is very likely that in terms of what has happened in the creation of an industrial sector we are witnessing a process to some extent similar to that which may have characterised the sequence of Japanese industrialization after the Second World War. This country is usually depicted as an example of a society with an outstanding technical capacity in the area of improvement and adaptation of foreign technology. Consonant with this relative advantage, Japanese industry paid less attention to basic research in many areas but, alternatively, dedicated a large proportion of its resources to perfecting acquired technologies, scoring a remarkable success in this direction and very frequently succeeding in making these techniques significantly more efficient than the originals 50/.

In this way, Japanese industry completed a cycle which begins with a long period of technological absorption, which has allowed it to partially close the technological gap with respect to the international frontier in many branches of industry. Subsequently, it has gone into the generation of its own technology, based fundamentally on the introduction of minor innovations which give rise to a modified version of the original know-how. Only in a final

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The results obtained were as follows:

$$\sum_{1969}^{1974} X = -79779.68 + \underset{(1.70)}{2.06} \sum_{1960}^{1968} Q + \underset{(87.74)}{226.66} \sum_{1960}^{1968} RD + u$$

For 14 observations R^2.62

Note, finally, that the correlation coefficients vary significantly depending on the number of observations included in the sample. This seems to be a general experience in this field, as we can see in Hufbauer's study, where by excluding the observations corresponding to just one country his results exhibit a considerable degree of variation in each one of the various theories he tests. See especially Table Nº 5, p.159 of Hufbauer's paper, op. cit.

50/ On this point, we recommend the article by K. Yamaura, "A Retrospect and Prospect on the Postwar Japanese Economy", in Explorations in Economic Research, Vol. 3, Nº 2, National Bureau of Economic Research, 1976.

stage does this technology, with its own characteristics, begin to be exported to those areas where it is more advantageous precisely because of the above-mentioned improvements and adaptations.

Bearing in mind the scale differences between Japan and some of the Latin American countries we are referring to, we are prepared to argue that in our view the latter may now be following a path in some ways comparable to that which has just been described for the Japanese case.

Even though it certainly is a less coherent overall situation, we believe that some of the same elements of technological learning are present, with a clear emphasis on minor innovations which play an important part in the building up of a new kind of intermediate technology, which in time acquires its own value as a saleable asset.

Let us now conclude briefly examining some worthwhile future lines of research which could further develop the ideas expressed here. Without doubt, the first area to be improved is related to the sample in which the present hypothesis should be tested. A larger number of Argentine firms should be included in the analysis, thus allowing a more balanced picture as far as the relative weight of local vis-à-vis multinational corporations is concerned. A broadening of the sample would also allow a more thorough statistical test of the relationship between exports and variables representative of technological performance.

Likewise, the need for a detailed examination of both the technical characteristics of the products exported and of the markets to which they are sent should be considered. As far as the first subject is concerned, the study at product level should be directed at discovering the forms taken by the technological activities involved which are locally performed. Thus, for example, to be able to determine how innovations introduced into products and/or processes are generated, which are the determinants of entrepreneurs' behaviour, as far as spending on R&D activities is concerned, what level of technical sophistication is needed in order to introduce significant modifications in a given particular technology, and in what ways this knowledge is different from that prevailing at the international frontier, etc. With regard to markets for this kind of goods, it seems necessary to establish the relations which exist between the degree of development of the productive structure of these countries and the kind of intermediate or modified technology which is incorporated into the exported goods, in order to be able to evaluate the potential advantages which planned development of

this kind of technology would give for the penetration into new markets.

December, 1976

APPENDIX I

Table I/1. Percentage of exports by Chapter of NADE covered by the companies.

Company	Chapters of NADE	Percentages of exports of these chapters between 1969-1974 accounted for by each Company	
Esso	27		70.3
Squibb	29 & 30	12.4	
Cyanamid	29 & 30	12.1	
Compañía Química	29 & 30	6.0	30.4
Ducilo	39 & 51		35.1
Pasa	40		46.7
Acindar	73	18.8	
Dálmine Siderca	73	15.5	34.3
Olivetti	84	18.5	
IBM	84	12.9	
Roque Vassalli	84	3.5	
Siam di Tella	84	3.3	38.1
Philips	85	11.3	
Fapesa	85	14.3	
Standard Electric	85	11.0	36.6
Fiat	87	24.1	
Mercedes Benz	87	17.3	
Ford Motor Argentina	87	10.0	
General Motors	87	6.6	
Citroën	87	6.5	64.5

Source: Drawn up by the authors from information supplied by the Companies.

Table I/2. Exports to LAFTA and the rest of the world, 1969-1974

(percentages of total exports of the company)

	Company	LAFTA							Outside the Area						
		1969	1970	1971	1972	1973	1974	Average	1969	1970	1971	1972	1973	1974	Average
1.	Olivetti	56	59	70	77	76	71	68	44	41	30	23	24	29	32
2.	Acindar	-	-	99	78	55	43	69	-	-	1	22	45	57	31
3.	Fiat	100	100	100	100	92	58	92	-	-	-	-	8	42	8
4.	Dálmine	80	72	45	58	39	68	60	20	28	55	42	61	32	40
5.	IBM	48	30	9	12	10	18	21	52	70	91	88	90	82	79
6.	Mercedes Benz	-	85	83	99	97	80	89	-	15	17	1	3	20	11
7.	Ford	96	86	12	29	21	17	44	4	14	88	71	79	83	56
8.	Esso	-	-	-	-	-	-	60	-	-	-	-	-	-	40
9.	Pasa Petroquímica	62	52	44	60	69	75	60	38	48	56	40	31	25	40
10.	General Motors	100	100	100	100	97	63	93	-	-	-	-	3	37	7
11.	Citroën	100	100	100	100	100	100	100	-	-	-	-	-	-	-
12.	Squibb	-	-	-	-	-	-	10	-	-	-	-	-	-	90
13.	Cyanamid	-	76	53	45	69	53	59	-	24	47	55	31	47	41
14.	Roque Vassalli	-	-	-	-	-	-	99	-	-	-	-	-	-	1
15.	Ducilo	65	100	100	79	82	90	86	35	-	-	21	18	10	14
16.	Siam di Tella	-	-	-	-	55	45	50	-	-	-	-	45	55	50
17.	Papesa	94	89	84	52	52	61	75	6	11	16	48	48	19	25
18.	Philips	100	100	99	100	100	100	100	-	-	1	-	-	-	-
19.	Standard Electric	-	-	-	-	-	-	80-90	-	-	-	-	-	-	10-20
20.	Compañía Química	94	95	84	78	85	94	88	6	5	16	22	15	6	12
	Totales							70							30

Source: Drawn up by the authors from data supplied by the Company.

Table I/3 Export Markets by Company

	Company	Destination of exports	Percentage of total exports	Complementation Agreements
1.	Olivetti	Brazil United States Mexico	45 28 14	yes no yes
2.	Acindar	United States Brazil Germany	39 30 8	no
3.	Fiat	Chile Uruguay	-	yes
4.	Dálmine	Venezuela Algiers United States	19 15 13	no
5.	IBM	Japan Canada Sweden	34 10 10	no
6.	Mercedes Benz	Chile Peru	46 30	no
7.	Ford	Uruguay Cuba Chile	24 18 10	yes no no
8.	Esso	Canada Brazil Uruguay	27 27 14	no
9.	Pasa Petroquímica	Chile, Colombia Uruguay, Peru	75	yes
10.	General Motors	Chile Cuba	65 35	yes no
11.	Citroën	Chile Uruguay	90 6	yes yes
12.	Squibb	Ireland	70	no
13.	Cyanamid	Brazil United States Chile	19 14 10	yes no no
14.	Roque Vassalli	Brazil Chile	60 25	no

Table I/3 (conclusion)

	Company	Destination of exports	Percentage of total exports	Complementation Agreements
15.	Ducilo	Brazil Uruguay Ecuador	31 24 8	no
16.	Siam di Tella	Mexico Africa	21 20	no
17.	Fapesa	Brazil Mexico	60 10	no
18.	Philips	Brazil Mexico	75 10	yes
19.	Standard Electric	Brazil	35	no
20.	Compañía Química	Mexico Colombia Brazil	36 23 20	no

Source: Drawn up by authors from data supplied by the Companies.

Table I/4. Exports of Finished and Semi-finished Products or Parts and Spare Parts, 1960 - 1974
(percentages of the company's total exports)

	Company	Finished Products							Semi-finished Products or Parts & Spare Parts						
		1969	1970	1971	1972	1973	1974	Average	1969	1970	1971	1972	1973	1974	Average
1.	Olivetti	100	100	99	99	99	98	99	-	-	1	1	1	2	1
2.	Acindar	-	-	100	100	100	100	100	-	-	-	-	-	-	-
3.	Fiat	100	61	74	66	58	68	71	-	39	26	34	42	32	29
4.	Dálmine	100	100	100	100	100	100	100	-	-	-	-	-	-	-
5.	IBM	75	64	77	42	60	65	64	25	36	23	58	40	35	36
6.	Mercedes Benz	-	78	76	94	89	89	85	-	22	24	6	11	11	15
7.	Ford	1	11	72	60	71	75	48	99	89	28	40	29	25	52
8.	Esso	-	-	-	-	-	-	100	-	-	-	-	-	-	-
9.	Pasa Petroquímica	-	-	-	-	-	-	100	-	-	-	-	-	-	-
10.	General Motors	100	100	87	77	87	74	88	-	-	13	23	13	26	12
11.	Citroen	5	-	1	-	6	8	3	95	100	99	100	94	92	97
12.	Squibb	-	-	-	-	-	-	100	-	-	-	-	-	-	-
13.	Cyanamid	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14.	Roque Vassalli	-	-	-	-	-	-	90	-	10	10	10	10	10	10
15.	Ducilo	100	100	100	100	100	100	100	-	-	-	-	-	-	-
16.	Siam di Tella	-	-	-	-	95	95	95	-	-	-	-	5	5	5
17.	Fapesa	-	-	-	-	-	-	100	-	-	-	-	-	-	-
18.	Philips	98	98	99	98	97	99	98	2	2	1	2	3	1	2
19.	Standard Electric	-	-	-	-	-	-	100	-	-	-	-	-	-	-
20.	Compañía Química	-	-	-	-	-	-	100	-	-	-	-	-	-	-

Source: Drawn up by authors from data supplied by the Companies.

Table I/5. Products Exported by the 20 Companies Analyzed

Company	Exported Finished Products	NADE Tariff Position	Percentage of Company's Total Exports	Parts and Spare Parts Exported	NADE Tariff Position	Percentage of Company's Total Exports
1. Olivetti	Electric, electronic and manual calculators.	84-52-00-01	84	For typewriters	84-55-00-01	yes
	Accounting machines	84-52-00-02	13	For calculating machines	84-55-00-02	yes
2. Acindar	Steel	73-10-01-00	36	-	-	-
	Steel cable	73-10-00-00	33			
	Barbed wire	73-26-00-00	16			
3. Fiat	Cars	87-02-01-00	29	-	-	yes
	Lorries	02-03-01	23			
	Tractors	01-01-01	18			
4. Dálmine	Seamless Tubes	73-18-02-09	100	-	-	-
5. IBM	Printers, card sorters, copiers	84-53-00-00	90	Units for data punching equipment & printers	84-55-00-05 84-02-00-01	To the Markets
6. Mercedes Benz	Trucks and buses	87-02-03-01	60	Cylinder heads	84-06-02-04	no
	Buses	02-02-01	30	Block-motor-connecting rods		
7. Ford	Light and heavy trucks	87-02-03-01	53	Falcon and F 100 units	87-02-01-00/03-01	yes
	Vehicles	87-02-03-00	12	Back axles	87-06-00-00	yes
				Rocker arms	84-06-02-04	yes
8. Esso	Coke	27-14-01-00	35	-	-	-
	Additives	27-10-01-00	35			
	Lubricants	27-10-06-01/2	15			

Table I/5 (cont.)

Company	Exported Finished Products	NADE Tariff Position	Percentage of Company's Total Exports	Parts and Spare Parts Exported	NADE Tariff Position	Percentage of Company's Total Exports
9. Pasa Petroquímica	Synthetic rubber Butadiene Benzine	40-02-00-00 29-01-02-01	100	-	-	yes
10. General Motors	Vehicles	87-02-01-00	90	Engines & parts	34-06-02-01	yes
11. Citroen	Vehicles	87-02-01-02	3	CKD - Kits	37-02-01-02	yes
12. Squibb	Antibiotics Human and Veterinary Medicines	29-44 30-03				
13. Cyanamid	Veterinary Medicines	30-03				yes
14. Roque Vassalli	Harvesters Harvesting Equipment	84-25-00-05 84-25-00-19	85 5	Chutes,granaries, platforms, sieves, transporters	84-25-00-13	no
15. Ducilo	Polyamidic fibres Cellophane Rayon	51-01-01-01 39-03-02-01 51-01-02-00	36 40 18	-	-	-
16. Siam di Tella	Bulldozers Regrigeration Equipment	84-23-00-09 84-15-02-02	35 24	-	-	-
17. Fapesa	Radio valves Television tubes Capacitors	85-21-00-01 85-21-00-09 85-18-00-01	40 30 15	-	-	-

Table I/5 (conclusion)

Company	Exported Finished Products	NADE Tariff Position	Percentage of Company's Total Exports	Parts and Spare Parts Exported	NADE Tariff Position	Percentage of Company's Total Exports
18. Philips	Electric shavers	85-07-00-01	75	Shaver kits	85-07-00-04	yes
	Refrigerators	84-15-03-01	7	Sintonizers	85-01-00-09	no
19. Standard Electric	Telephone Exchanges	85-13-00-01	-	-	-	-
20. Compañía Química	Tartaric acid	29-16-00-03	68	-	-	-
	Cream of tartar	00-14	22	-	-	-

Source: Drawn up by authors from data supplied by the Companies.

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